FINEST®

500

DIGITAL MULTIMETER

Please read before using this equipment.

USER'S MANUAL

FINEST® a world leader in test & measurement

FINE INSTRUMENTS CORPORATION

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WARNING!

SOURCES LIKE SMALL HAND-HELD RADIO TRANSCEIVERS, FIXED STATION RADIO AND TELEVISION TRANSMITTERS, VEHICLE RADIO TRANSMITTERS AND CELLULAR PHONES GENERATE ELECTROMAGNETIC RADIATION THAT MAY INDUCE VOLTAGES IN THE TEST LEADS OF THE MULTIMETER. IN SUCH CASES THE ACCURACY OF THE MULTIMETER CANNOT BE GUARANTEED DUE TO PHYSICAL REASONS.

Measurement Limits:

DC Voltage	:	0.1mV to 1000V
AC Voltage	:	1mV to 750V
DC Amperes	:	0.1µA to 10A
AC Amperes	:	0.1µA to 10A
Resistance	:	0.1Ω to 20MΩ
Continuity Check	:	Beep at Approx. < 150Ω in the 200Ω range

WARNING!

READ "SAFETY CONSIDERATIONS" BEFORE USING THIS METER.

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1. INTRODUCTION

This Meter is a handheld and battery operated instrument that is designed and tested according to IEC Publication 1010-1 (EN 61010-1) (Overvoltage Category ll), the EMC Directive (EN 50081-1 and EN 50082-1) and other safety standards (see “Specifications”).

Features:

- Accurate measurements of non-filtered (rectified AC) DC signals
- $3^1/_2$ digit, 2000 count digital display
- Manual ranging
- Fused 10 Amps range
- DC voltage basic accuracy within 0.5%
- Date hold
- Continuity beeper and diode test
- 600 volt input protection on ohm range
- Hold and Low-battery annunciators
- Rubber boot (or Safety holster)
- Large LCD display (68.5mm x 32.7mm)

2. SAFETY CONSIDERATIONS

Before using this Meter, read the following safety information carefully. In this manual, the word “WARNING” is used for conditions and actions that pose hazard(s) to the user; the word “CAUTION” is used for conditions and actions that may damage this Meter.

International Symbols

Dangerous Voltage (Risk of electric shock)

Alternating Current (AC)

Direct Current (DC)

Either DC or AC

Ground (Allowable applied voltage range between the input terminal and earth)

Caution! Refer to the user’s manual before using this Meter.

Double Insulation (Protection Class ll)

Fuse

WARNING!

OBSERVE ALL SAFETY PRECAUTIONS WHEN MEASURING HIGHER VOLTAGES AND/OR CURRENTS. TURN OFF POWER TO THE CIRCUIT UNDER TEST, SET THIS METER TO THE DESIRED FUNCTION AND RANGE, CONNECT THE TEST LEADS TO THIS METER AND THEN TO THE CIRCUIT UNDER TEST. REAPPLY POWER. IF AN ERRONEOUS READING IS OBSERVED, DISCONNECT POWER IMMEDIATELY AND RECHECK ALL SETTINGS AND CONNECTIONS.

Safety Tips:

- Do not try to measure any voltage that exceeds 1000V DC or 750V AC RMS.
- Voltages above 60V DC or 25V AC RMS may constitute a serious shock hazard.
- Do not attempt to use this Meter if either the Meter or the test leads have been damaged.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the test leads, keep your fingers away from probe contacts. Always grip behind the finger guards on the probes.
- Use a current clamp if measuring any current above 10 Amps.

3. EXPLANATION OF CONTROLS AND INDICATORS

1 – DIGITAL DISPLAY. Digital readings are displayed on a 2000 count display with polarity indication.The display updates three times per second.

2 – **.** Selects meter's power ON or power OFF.

3 – **.** Freezes reading in digital display.

4 – ROTARY SWITCH. Describes functions that are selected by setting the rotary switch.

V Volts ac V Volts dc A Amperes ac

A Amperes dc Ω Resistance Continuity Test

Diode Test

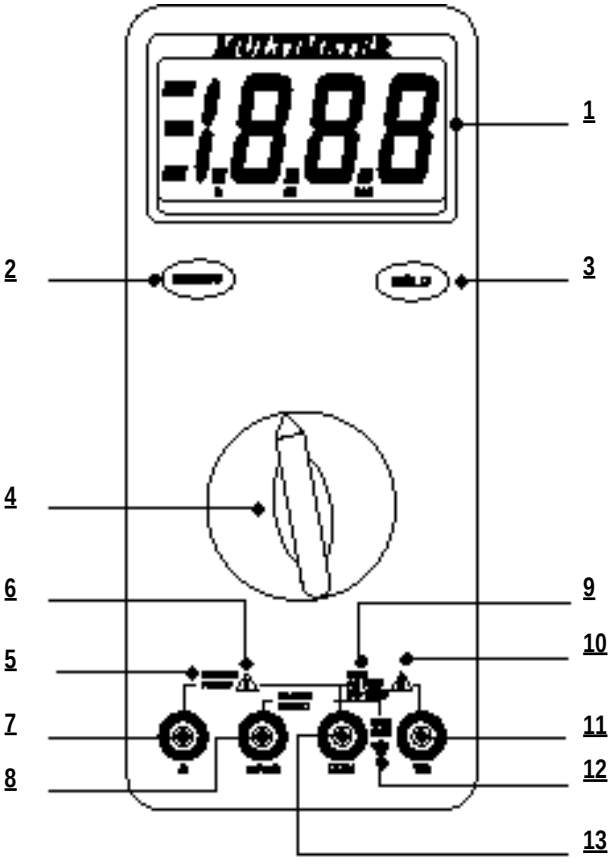
10A MAX

5 – FUSED . The maximum current that you can measure at this terminal is 10 Amps DC/AC.
This terminal is fuse

6 – **.** Refer to the user's manual before using this Meter.

7 – A (Amperes Input Terminal). The red test lead is plugged into this terminal for measuring current on the 10A AC or DC current functions.

8 – mA µA (Milliamp/Microamp Input Terminal). The red test lead is plugged into this terminal for measuring mA or µA on either AC or DC current functions.



9 – **MAX AC 750V DC 1000V .** The maximum voltage that this Meter can measure is 1000V DC or 750V AC RMS.

10 – . Be extremely careful when making high-voltage measurement; DO NOT TOUCH TERMINALS OR TEST LEAD PROBE ENDS.

11 – **VΩ (Volt, Ohms, Diode Test Input Terminal).** The red test lead is plugged into this terminal for all AC V, DC V, Ohms, Continuity test and Diode test functions.

12 – **MAX 600V .** To avoid electrical shock or instrument damage, do not connect the COM input terminal to any source of more than 600V with respect to earth/ground.

13 – **COM (Common Terminal).** The black test lead is plugged into this terminal for all measurements.

14 – **HOLD .** Displayed when the HOLD button has been pressed.

15 – **(Negative Polarity).** Automatically indicate negative inputs.

16 – **(Low Battery).** Battery run-out warning. When is first displayed, at least 8 hours of battery life remain. Replace the battery immediately. Never leave a weak or dead battery in the Meter. Even leak-proof types can leak and damages the Meter.

17 – I **... (Overload Indication).** Displayed on the LCD when input is too large to display.

Using Test Leads

Use only the same type of test leads as are supplied with the Meter. These test leads are rated for 1200 volts. Although these test leads are rated for 1200 volts, do not try to measure any voltage greater than 1000 volts DC or 750 volts AC.

NOTE: In some DC and AC voltage ranges with test leads not connected to any circuits, the display might show fluctuating readings due to the high input impedance. This is normal. When you connect the test leads to a circuit, a real measurement appears.

Using Holster and Stand

The Meter comes with a protective holster that absorbs shocks and protects the Meter from rough handling. The holster is equipped with a stand rest.

4. BASIC ELECTRICAL TESTS AND MEASUREMENTS

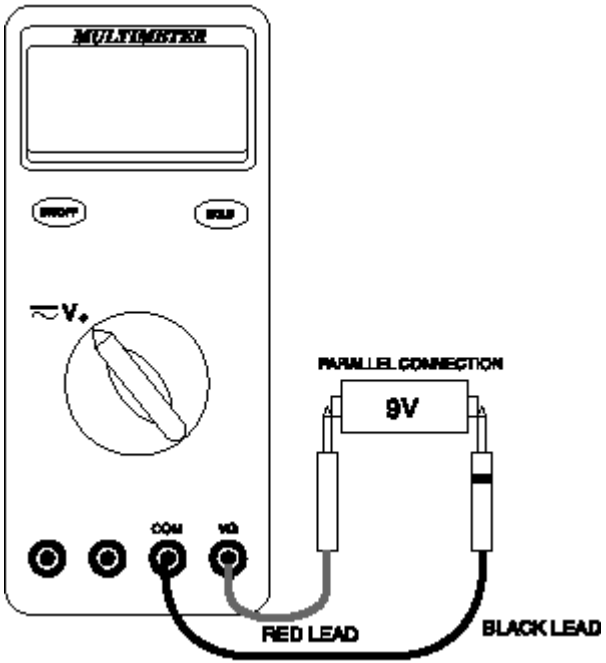
4.1 Measuring Voltage

WARNINGS!

TO AVOID THE RISK OF ELECTRICAL SHOCK AND INSTRUMENT DAMAGE, INPUT VOLTAGES MUST NOT EXCEED 1000V DC OR 750V AC (RMS). DO NOT ATTEMPT TO TAKE ANY UNKNOWN VOLTAGE MEASUREMENT THAT MAY BE IN EXCESS OF 1000V DC OR 750V AC (RMS).

THIS METER IS DESIGNED FOR MEASUREMENT IN WEAK CURRENT CIRCUITS. DO NOT USE IT FOR STRONG CURRENT CIRCUITS (POWER LINE IN FACTORIES AND SO ON HAVING LARGE CURRENT CAPACITY). USE IN STRONG CURRENT CIRCUITS IS VERY DANGEROUS BECAUSE SURGE VOLTAGE IN FAR EXCESS OF RATING IS OFTEN APPLIED TO THEM.

NOTE: When taking voltage measurements, this Meter must be connected in PARALLEL with the circuit, or circuit element under test.



- In 200mV range, displayed value may fluctuate when disconnecting input terminals. This is normal.
- AC voltage measuring circuit in this Meter is of mean value system so an AC waveform other than a sine wave causes error.

- To improve the accuracy of DC voltage measurements taken in the presence of AC voltages (such as, measuring the DC offset voltage of an amplifier in the presence of an AC signal), measure the AC voltage first. Note the just measured AC voltage range and select a DC voltage range that is the same or higher than the AC voltage range. This method improves the DC voltage accuracy by preventing the input protection circuit from being activated.

Follow these steps to measure DC (or AC) volts.

1. Set function and range switch to the desired DC V (or AC V) range. If you do not know the value of the voltage to be measured, always start with the highest range and reduce the setting as required to obtain a satisfactory reading.
2. Plug the red test lead into the "VΩ" input terminal and the black lead into the "COM" input terminal of the instrument.
3. Disconnect the power from the circuit to be tested.
4. Connect the test leads to the circuit to be tested.
5. Reapply power to the circuit, the measured voltage will appear on the display of the instrument.
6. If the red test lead is connected to the negative (or lower voltage) side of the circuit, a minus sign will appear on the display, at the left.
7. Disconnect power to the circuit before removing the test leads from the circuit.

Three-Phase AC Volts

This Meter is designed to primarily measure household AC voltage. When measuring THREE-PHASE circuit line-to-line, the value of the voltage is actually higher than the rated line-to-ground 3-phase voltage. It is very important that you do not exceed the maximum AC (RMS) rating of this Meter, 750V AC.

To find the RMS voltage line-to-line on a 3-phase power line, multiply the rated line-to-ground voltage by the square root of 3 (approx. 1.732).

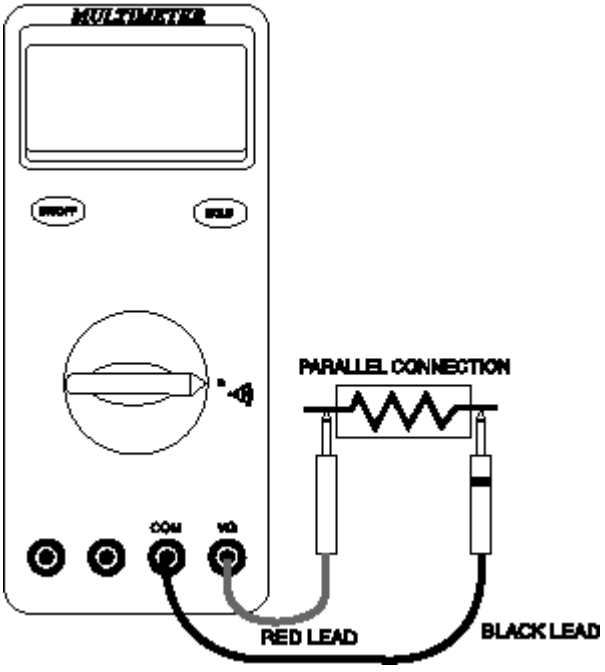
For example, if you connect this Meter to a 480 volts 3-phase line (i.e.480V line-to-ground), the total available voltage line-to-line is about 832V AC (480V x 1.732). Severe damage and a dangerous shock hazard could result because this exceeds the rating of this Meter.

4.2 Measuring Resistance (Ohms, Continuity)

CAUTION!

TURN OFF POWER AND DISCHARGE ALL CAPACITORS ON CIRCUIT TO BE TESTED BEFORE ATTEMPTING INCIRCUIT RESISTANCE MEASUREMENTS. FAILURE TO DO SO MAY END UP IN EQUIPMENT (AND/OR INSTRUMENT) DAMAGE.
THE RESISTANCE MEASURING CIRCUIT APPLIES A KNOWN VALUE OF CONSTANT CURRENT THROUGH THE UNKNOWN RESISTANCE AND THEN MEASURES THE VOLTAGE DEVELOPED ACROSS IT. THEREFORE, REMOVE ALL POWER TO THE CIRCUIT UNDER TEST WHEN MAKING RESISTANCE MEASUREMENT. IF ANY VOLTAGE IS PRESENT IN THE TEST CIRCUIT, AN ERRONEOUS READING WILL RESULT. THIS METER MAY BE DAMAGED IF VOLTAGE IN EXCESS OF 600V AC IS PRESENT.

NOTE: When measuring critically low Ohm values, touch tips of test leads together and record the reading. Subtract this reading from any additional measurement to obtain the most accurate value.



- When measuring large resistance, reading may be unstable due to environmentally induced electrical noise. In this case, directly connect the resistor to input terminals of the meter or shield the resistor at potential of the COM input terminal to obtain stable reading.

- For resistance above 1 Megohm, the display might take a few seconds to stabilize. This is normal for high-resistance readings.

- The Meter has a circuit to protect the resistance range from over-voltage (600V AC). However, to prevent accidentally exceeding the protection circuit's rating and to ensure a correct measurement, NEVER CONNECT THE TEST LEADS TO A SOURCE OF VOLTAGE when the rotary switch is set to Ω or functions.

- The current applied during resistance measurements could damage some devices. The table below lists the test voltage and current available for each resistance measurement range. (All values are typical.)

RANGE	OPEN CIRCUIT VOLTAGE (A)	FULL SCALE VOLTAGE (B)	SHORT CIRCUIT CURRENT (C)
200 Ω		< 150 mV	< 695 µA
2 KΩ		< 550 mV	< 470 µA
20 KΩ	< 1.2 V	< 700 mV	< 95 µA
200 KΩ		< 750 mV	< 10.5 µA
2 MΩ		< 800 mV	< 1.1 µA
20 MΩ		< 800 mV	< 0.2 µA

NOTE: (A) is the open circuit test voltage at the input terminals in volts.
(B) is the voltage drop across a resistance equal to full scale value.
(C) is the current through a short circuit at the input terminals.

4.2.1 Measuring Ohms

When measuring resistance, be sure that the contact between the test leads and the circuit under test is good. Dirt, oil, solder flux, or other foreign matter seriously affect the reading value.

Follow these step to measure ohms.

1. Set the Function switch to the desired "Ω" position.
2. Insert the black test lead into the "COM" input terminal and the red test lead into the "VΩ" input terminal.
3. Connect the test leads to the circuit to be measured.
4. The measured resistance will be on the LCD.

4.2.2. Continuity Test

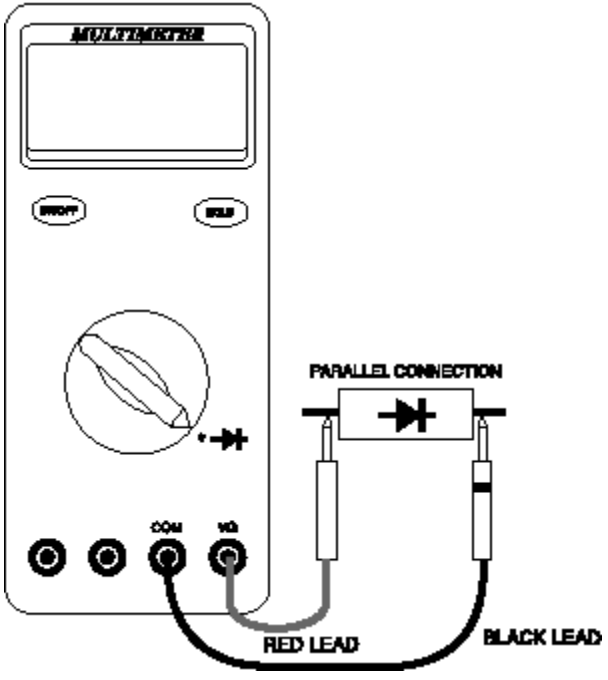
This mode helps you check electrical circuits, such as wiring, speaker cables, connections, switchers, or relays for short or open circuits. In continuity test, a measured value of approx. 150Ω or less causes the Meter to emit a continuous tone.

Follow these steps to check continuity

1. Set the Function switch to the " " position.
2. Insert the black test lead into the "COM" input terminal and the red test lead into the "VΩ" input terminal.
3. Connect the test leads to the circuit to be measured.
4. This Meter will emit a continuous tone for resistances of less than 150 ohms.

4.3 Diode Test & Microwave Didoes

Diode test lets you check didoes, transistors, and other semiconductors for opens, short, and normal operation. NEVER CONNECT THE TEST LEADS TO A SOURCE OF VOLTAGE when the rotary switch is set to .



- In diode test, drop voltage in the forward direction is displayed when diode is connected in the forward direction. For a germanium diode, the typical forward voltage is about 0.4V and in case of a silicon diode, about 0.6V.
- Judge the semiconductor device as follows:

  It the digital reading in one direction shows a value and the reading in reverse direction shows an overload (I **...**). the device is good.

  If the digital reading is the same in both directions, the device is probably shorted.
  If the display reads I **...** in both directions, the device is probably open.

4.3.1 Diode Test

Follow these steps to check a diode.

1. Set the Function switch to the " " position.
2. Insert the black test lead into the "COM" input terminal and the red test lead into the "VΩ" input terminal.
3. Touch the red test lead to the Anode (+ side. non-banded end) and the black test lead to the Cathode (- side. banded end).
4. If the diode is good, the reading should indicate 0.3V to 0.8V on the LCD.
5. Reverse the red and black leads on the diode, if the LCD reads I ... (the overload sign) the diode is good.

NOTE: A defective diode will read I ... (the overload sign) or 0.00 no matter how the test leads are connected.

4.3.2 Microwave Didoes

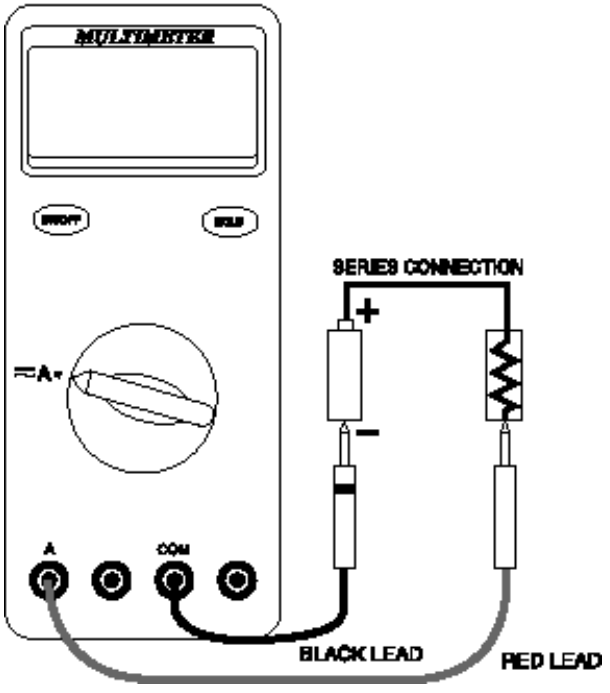
Most microwave didoes can not be tested by a DMM with a diode test function. This is because the DMM does not supply enough power to turn these diode on. We offer an accessory test lead, model TL60, that boosts the power output so that microwave didoes can be adequately tested. Consult your distributor for more details.

4.4 Measuring Current (Amps)

CAUTION!

THE CURRENT FUNCTIONS ARE PROTECTED BY A FUSE OF 600 VOLT RATING. TO AVOID DAMAGE TO THE INSTRUMENT, CURRENT SOURCES HAVING OPEN CIRCUIT VOLTAGES GREATER THAN 600 VOLTS DC OR AC MUST NOT BE MEASURED.

NOTE: When taking current measurements, this Meter must be connected in SERIES with the circuit (or circuit element) under test. NEVER CONNECT THE TEST LEADS ACROSS A VOLTAGE SOURCE while the rotary switch is set to Amps. This can cause damage to the circuit under test or this Meter.



- To measure current, you must break the circuit and connect the test leads to two circuit connection points. The connection must be in series with the current.
- In alternating current measurement, waveforms other than sine wave causes error.

- When measuring current, the Meter's internal shunt resistors develop a voltage across the meter's terminals called "burden voltage". This voltage drop may affect precision circuits or measurements.

Follow these steps to measure DC (or AC) Amps.

1. Set function and range switch to the desired DC A (or AC A)range. If you do not know the value of the current to be measured, always start with the highest range and reduce the setting as required to obtain a satisfactory reading.
2. Plug the red test lead into the "mAμA" input terminal (if the10A range is being used, plug the red lead into the "A" input terminal) and the black lead into the "COM" input terminal of the instrument.
3. Disconnect the power from the circuit to be tested.
4. Connect the test leads in series to the circuit to be tested.
5. Reapply power to the circuit, the measured current will appear on the display of the instrument.
6. Disconnect power to the circuit before removing the test leads from the circuit.

5. MAINTENANCE AND REPLACEABLE PARTS

5.1 General Maintenance

WARNING!

REPAIRS OR SERVICING NOT COVERED IN THIS MANUAL SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL. TO AVOID ELECTRICAL SHOCK, DO NOT SERVICE UNLESS YOU ARE QUALIFIED TO DO SO.

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents. Water, dirt, or contamination in the A or mAμA input terminals may harm this Meter.

Calibrate this Meter once a year to maintain its performance specifications.

5.2 Battery Replacement

The Meter uses a 9V battery (NEDA 1604 or IEC 6F22). To replace the battery, remove the two screws of the battery compartment from the back of the Meter and lift off the cover of the compartment. Replace the battery. Reattach the battery compartment to the back of the Meter, and reinstall the screws.

5.3 Fuse(s) Test And Replacement

5.3.1 Fuse(s) Test

To test the internal fuses of this Meter:

1. Set the rotary switch to " ⊣⊢ " position.
2. Turn this Meter on.
3. To test F2 (15A, 600v), plug a test lead into the VΩ input terminal and touch the probe to the A input terminal.
   The display should read about 0.000V. If the display reads *i* ... (overload), replace the fuse and test again. If the display reads any other value, have this Meter serviced.
4 To test F1 (2A, 600V), move the probe from the A input terminal to the mAμA input terminal.
   The display should read 0.5V~0.6V. If the display reads *i* ... (overload), replace the fuse and test again. If the display reads any other value, have this Meter serviced.

5.3.2 Fuse(s) Replacement

1. Unplug the test leads. Remove the rubber boot from the instrument.
2. Remove the screws in the rear of the instrument and separate the front and rear housing.
3. Replace the fuses(s) with the same type and size as the one removed.
4. Snap the front and rear housing back together and reinstall the screws.
5. Reattach the rubber boot.

6. ACCESSORIES

NOTE: When servicing the Meter, use only the replaceable parts specified.

BT1	Battery, 9 Volt
F1	Fuse 2A, 600V RMS
F2	Fuse 15A, 600V RMS
TL1	Test Lead Set
C2Y	Rubber Boot (Yellow)

7. SPECIFICATIONS

7.1 Specifications

Accuracy is given as ±([% of reading] + [number of least significant digits]) at 18°C to 28°C with relative humidity up to 80%, for a period of one year after calibration.

FUNCTION	RANGE	RESOLUTION	ACCURACY	REMARKS
DC V	200mV	100µV	± (0.5% + 1 dgt)	Input Impedance: 10MΩ
	2V	1mV		
	20V	10mV		
	200V	0.1V		
	1000V	1V		
AC V (45Hz to 450Hz)	200mV	100µV	± (0.8% + 3 dgts)	Input Impedance: 10MΩ
	2V	1mV		
	20V	10mV		
	200V	0.1V		
	750V	1V	± (1.2% + 3 dgts)	
DC A	200µA	0.1µA	± (0.8% + 1 dgt)	VOLTAGE DROP: 1mV/µA
	2mA	1µA		100mV/µA
	20mA	10µA		10mV/mA
	200mA	100µA		1.2mV/mA
	2A	1mA		0.28V/A
	10A	10mA	± (2.0% + 10 dgts)	0.22V/A

FUNCTION	RANGE	RESOLUTION	ACCURACY	REMARKS
AC A (45Hz to 450Hz)	200µA	0.1µA	± (1.0% + 3 dgts)	VOLTAGE DROP: 1mV/µA
	2mA	1µA		100mV/µA
	20mA	10µA		10mV/mA
	200mA	100µA		1.2mV/mA
	2A	1mA		0.28V/A
	10A	10mA	± (3.0% + 10 dgts)	0.22V/A
Ohms	200Ω	0.1Ω	± (0.5% + 10 dgts)	OPEN CIRCUIT VOLTAGE < 1.2V
	2KΩ	1Ω	± (0.5% + 1 dgt)	
	20KΩ	10Ω		
	200KΩ	0.1KΩ		
	2MΩ	1KΩ		
	20MΩ	10KΩ	± (1.0% + 2 dgt)	
Continuity	OPEN CIRCUIT TEST VOLTAGE: < 1.2V THRESHOLD. Approx. < 150Ω			
Diode Check	OPEN CIRCUIT TEST VOLTAGE: < 3V MAX. TEST CURRENT: 1mA			

NOTE:

DC V. NORMAL MODE REJECTION RATIO: > 46dB at 50Hz or 60Hz
COMMON MODE REJECTION RATIO: > 104dB at dc, 50Hz or 60Hz
AC V. COMMON MODE REJECTION RATIO: > 80dB at dc, to 60Hz
FUSE PROTECTION. µA or mA : 2A 600V FAST fuse
A : 15A 600V FAST fuse
with > 10000A interrupt rating

7.2 Maximum Inputs

FUNCTION	INPUT TERMINAL		MAXIMUM INPUT
	RED LEAD	BLACK LEAD	
⎓ V	VΩ	COM	1000V
~ V	VΩ	COM	750V
Ω	VΩ	COM	600V
◀	VΩ	COM	600V
⊣⊢	VΩ	COM	600V
A ⎓	A	COM	10A/600V
mA ⎓	mAμA	COM	2A/600V
μA ⎓	mAμA	COM	2A/600V

7.3 General Specifications

Display (LCD)
Digital : Counts – 2000
Updates 3 times/sec

Fuse Protection
mA or μA : 2A 600V HIGH ENERGY/FAST FUSE
A : 15A 600V HIGH ENERGY/FAST FUSE

Storage Temperature : –20°C to 60°C (–4°F to 140°F)

Operating Temperature : 0°C to 45°C (32°F to113°F)

Relative Humidity : 0% to 80% (0°C to 35°C; 32°F to 95°F)
0% to 70% (35°C to 45°C; 95°F to 113°F)

Temperature Coefficient: 0.10 x (Specified Accuracy)/°C
(< 18°C or > 28°C; <64°F or >82°F)

Temperature Coefficient: 0.10 x (Specified Accuracy)/°C
(< 18°C or > 28°C; <64°F or >82°F)

Battery Type : 9V, NEDA 1604 or 6F22 or 006P

Battery Life : 350 hrs typical (alkaline)

Size (H x W x L)
Meter Only : 4.0 cm x 8.5 cm x 19.0 cm
With Holster : 5.4cm x 10.3 cm x 20.8 cm

Weight
Meter Only : 380g
With Holster : 655g

Vibration & Shock : Designed to MIL-T-28899 for a Class II instrument

Safety Standards : Designed to both IEC 1010-1 (Overvoltage Category II), and the EMC Directive, UL 1244, CSA C22.2 No. 231 and ISA-DS82